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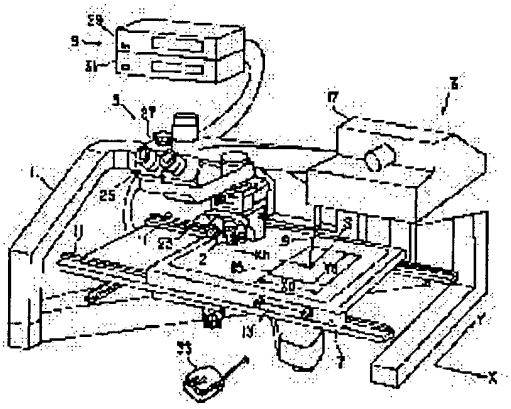
(54) SUBSTRATE OBSERVING DEVICE

(57)Abstract:
PURPOSE: To provide a compact substrate observing device capable of precisely switching the macro-observation and micro-observation in a short time regardless of the type of a substrate and capable of micro-observing multiple defect portions on the substrate found in the macro-observation continuously and precisely.
CONSTITUTION: A substrate observing device is provided with a macro-observation system 3 radiating the illumination light to the whole surface of a test substrate 15 to observe defect portions on the surface of the test substrate 15 based on the optical change of the reflected illumination light and a micro-observation system 5 expanding and observing the detected defect portions. The substrate observing device can move the test substrate 15 mounted between the macro-observation system 3 and the micro-observation system 5, and it is provided with an X-Y stage 7 with a scale positioning the test substrate 15 in the observation area of the macro-observation system 3 or the micro- observation system 5, and a coordinate display device 9 displaying the relative coordinates between the spot illumination of a spot lighting system 19 provided on the macro-observation system 3 and the objective optical axis of the micro- observation system 5.



LEGAL STATUS

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the substrate observation equipment for carrying out the microscopic inspection (micro observation being called hereafter) of the defective part, after conducting visual inspection (macro observation is called hereafter) of substrates, such as a wafer or a liquid crystal glass substrate.
[0002]
[Description of the Prior Art] Conventionally, in inspection of a substrate, when macro observation was performed for every film attachment process and etching process and the defect on a substrate was discovered in macro observation, micro observation was further performed under the microscope about a part for this defective part.
[0003] However, since such macro observation and micro observation were individually performed on the independent stage, respectively, it was very difficult at the time of the shift to the micro observation from macro observation to position a part for the defective part on the substrate discovered by macro observation just under the objective lens used by micro observation (namely, under an object optical axis). Then, the stage move equipment from which the evil mentioned above was removed is indicated by JP,2-259094,A.
[0004] A twice [low] (0.5x-2x) as many objective lens as it enters [spotlighting or] a cross, [which was prepared in the position which avoided from the X-Y stage in which this stage move equipment does not have a scale and the object optical axis of a microscope] ********** and visual observation -- and -- low -- after making the amount of [which was discovered by twice observation] defective part agree in a spot position or a cross, it is constituted so that fixed quantity movement (only an objective lens and the distance between spots specifically move) of the stage may be carried out and a part for a defective part may be positioned in the bottom of a microscope object optical axis
[0005]
[Problem(s) to be Solved by the Invention] However, whenever one defective part is discovered since parts for two or more defective part are not memorizable because of the following process while adding still more nearly special composition to a stage move mechanism with such equipment, in order to carry out fixed quantity movement of the X-Y stage, every, X-Y stage movement must be carried out, micro observation must be performed, substrate observation takes time, and it is trouble. and the mechanism for fixed quantity movement in order [being several times as large as a wafer] to inspect a liquid crystal substrate, for example -- not enlarging -- it does not obtain but there is design top unreasonableness
[0006] this invention is made in order to remove such evil, and the purpose does not ask the kind of substrate but is to offer the compact substrate observation equipment which can carry out micro observation of the part for the defective part of a short time and the plurality on the substrate discovered at the time of macro observation while being able to carry out with high precision for a change with macro observation and micro observation continuously and with high precision.
[0007]
[Means for Solving the Problem] It is the micro observation system which expands a part for the aforementioned defective part detected through the macro observation system which observes a part for the defective part which the substrate observation equipment of this invention illuminates lighting light on the whole inspected substrate front face, and exists in the aforementioned inspected substrate front face from optical change of the reflected light, and this macro observation system in order to attain such a purpose, and observes, and [0008]. Between the aforementioned macroscopic observation system and the aforementioned micro observation systems constitutes possible [movement], where the aforementioned inspected substrate is laid, and it has the coordinate display display the relative coordinate between the X-Y stage with a scale position the laid aforementioned inspected substrate in the observation field of the aforementioned macroscopic observation system or the aforementioned micro observation system, and spotlighting of spotlighting equipment and the object optical axis of the aforementioned micro observation system which were prepared in the aforementioned macroscopic observation system.
[0009]
[Function] After measuring the relative distance between the object optical axis of a micro observation system, and spotlighting of spotlighting equipment and carrying out memory to coordinate display, an X-Y stage is moved in the observation field of a macro observation system, and the appearance of an inspected substrate is observed. When a part for a defective part is discovered in macro observation, an inspected substrate is moved and the spotlighting position of spotlighting equipment is made to adjust a part for this defective part by the X-Y stage. And an inspected substrate is moved in the direction of a micro observation system

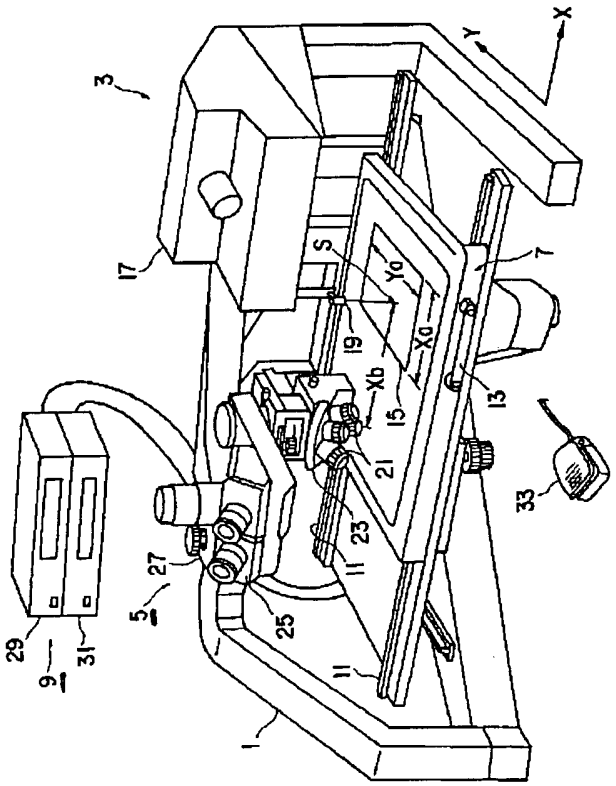
by the X-Y stage by the relative distance by which memory was carried out. Consequently, adjustment arrangement of the part for the defective part of an inspected substrate front face is carried out under the object optical axis of a micro observation system. And micro observation for a defective part of an inspected substrate front face is performed through a micro observation system.
[0010]
[Example] Hereafter, the substrate observation equipment concerning one example of this invention is explained with reference to drawing 1 or drawing 3 .
[0011] As shown in drawing 1 , the substrate observation equipment of this example is equipped with X-Y stage 7 with a scale which has the function to move between the macro observation system 3, the micro observation system 5, and these observation systems 3 and 5 to the single main part 1 of equipment, and to position the inspected substrate 15 in the observation field of the macro observation system 3 or the micro observation system 5, and the coordinate display 9 which displays the relative coordinate the macro observation system 3 and between micro observation system 5.
[0012] X-Y stage 7 is laid free [sliding] on the guide 11 of the couple prepared in the direction of X by extending at the lower part of the main part 1 of equipment, and is constituted possible [movement in the direction of X, or the direction of Y] by the stage handle 13 prepared in the unilateral of this X-Y stage 7.
[0013] That is, with the substrate observation equipment of this example, the inspected substrate 15 laid on X-Y stage 7 can be positioned only by moving X-Y stage 7 in the observation field of the macro observation system 3 or the micro observation system 5.
[0014] In addition, the stage stroke of the direction of X is specified to (2 Xa+Xb), and, as for X-Y stage 7 applied to this example, the stage stroke of the direction of Y is specified to (Ya). In addition, the relative distance between the object optical axis of the microscope 27 under which the size of the direction of X of the inspected substrate 15 and Xb mention Xa later, and spotlighting of spotlighting equipment 19, and Ya show the size of the direction of Y of the inspected substrate 15.
[0015] The macro observation system 3 is the upper part of the main part 1 of equipment, it meets the guide 11 of a couple, is arranged at the direction end side of X, and is equipped with the macro lighting unit 17 which illuminates macro lighting light on the inspected substrate 15 positioned by X-Y stage 7 in the observation field of the macro observation system 3, and the spotlighting equipment 19 which illuminates spotlighting light on this inspected substrate 15.
[0016] Fresnel lens 10 (5mm in thickness) for condensing which especially the macro lighting unit 17 has composition as shown in drawing 3 , is allotted into a macro lighting optical path, and regulates an incident light to the parallel flux of light, Fresnel lens 12 (5mm in thickness) for floodlighting which is constituted possible [insertion and detachment] to the parallel flux of light by which the light guide was carried out through this Fresnel lens 10 for condensing, and regulates the parallel flux of light by which the light guide was carried out to the convergence flux of light, It was constituted possible [insertion and detachment] to the convergence flux of light by which the light guide was carried out through this Fresnel lens 12 for floodlighting, and has the scattered plate 14 which gives an optical property to the convergence flux of light by which the light guide was carried out, and illuminates the inspected substrate 15 top.
[0017] Fresnel lens 10 for condensing, Fresnel lens 12 for floodlighting, and the scattered plate 14 have the bigger path (about 500-600mm) than the large-sized inspected substrate 15 of 500mm or more of vertical angles in **. For this reason, even when observing this large-sized inspected substrate 15, the whole substrate front face can be covered and macro lighting light can be made to illuminate without spots with the substrate observation equipment of this example.
[0018] Moreover, the metal halide lamp (150-250W) is applied to the light source 16 applied to the macro lighting unit 17. such the light source 16 -- the point emitting light -- an ellipse -- surface of revolution -- it is positioned in the 1st focus of a mirror 18, and it is constituted so that it may become the gate 20 in which the scattered plate was prepared for the 2nd focus of the ellipse rotation mirror 18 Moreover, the distance between the gate 20 and Fresnel lens 10 for condensing is in agreement with the focal distance (f) of this Fresnel lens 10 for condensing.
[0019] In addition, the heat absorbing filter 22 is formed between the light source 16 and the gate 20. Moreover, the scattered plate arranged on the gate 20 has the size of 20-30mm, and has the function to which outgoing radiation of the uniform lighting light is carried out from the gate 20.
[0020] In the macro lighting unit 17 which has such composition, the lighting light which emitted light from the light source 16 penetrates filters (green, yellow, polarizing plate, etc.) 24 through the ellipse rotation mirror 18, a heat absorbing filter 22, and the gate 20, and is irradiated by Fresnel lens 10 for condensing. The lighting light irradiated by Fresnel lens 10 for condensing is regulated by the parallel flux of light, and is irradiated by the scattered plate 14 through Fresnel lens 12 for floodlighting. The lighting light which penetrated this scattered plate 14 turns into shear dregs ten lighting light, serves as the uniform surface light source, and illuminates without spots the whole front face of the large-sized inspected substrate 15 positioned by X-Y stage 7 in the observation field of the macro observation system 3.
[0021] In addition, such the surface light source especially is suitable for inspection of the spots of thickness, such as a resist on a substrate, the pinhole on a transparent electric conduction film (ITO), the contaminant under a film, etc., etc., covers the whole front face of the inspected substrate 15, and serves as a uniform illuminance. Consequently, it becomes possible to observe the interference pattern formed when the amount of [of foreign matter 26 grade] defective part exists in a substrate front face with high precision through an observer's eyes 28.
[0022] Especially spotlighting equipment 19 has composition as shown in drawing 2 , and the red laser beam 2 by which outgoing radiation was carried out from the red light emitting diode (not shown) prepared in substrate observation equipment is irradiated by the lens 8 through opening 6, after an optical distribution is uniformly regulated by the obscured glass 4. With this

lens 8, a red laser beam serves as spotlighting and carries out image formation to the front face of the inspected substrate 15 positioned by X-Y stage 7 in the observation field of the macro observation system 3.
[0023] Moreover, as shown in drawing 1 , the micro observation system 5 is the upper part of the main part 1 of equipment, meets the guide 11 of a couple, is arranged at the direction other end side of X, and is equipped with the rotating type revolver 23 in which two or more objective lenses 21 with which scale factors differ were attached possible [exchange], and the microscope 27 which has 3 spectacles cylinders 25.
[0024] The coordinate display 9 has the function which displays the relative coordinate on the object optical axis of a microscope 27, and X-Y stage 7 between [of spotlighting equipment 19] spot positions, and is equipped with the X-axis address counter 29 and the Y-axis address counter 31. Next, operation of the substrate observation equipment of this example is explained with reference to drawing 1 . First, the following processings are performed in order to measure the relative distance between the object optical axis of a microscope 27, and spotlighting of spotlighting equipment 19 (Xb).
[0025] (1) Move X-Y stage 7 and position the inspected substrate 15 in the observation field of the micro observation system 5. At this time, an object optical axis sets to S the point of crossing the inspected substrate 15, and the X-axis address counter 29 and the Y-axis address counter 31 are reset for the coordinate in this point (S) as (0, 0).
[0026] (2) Next, move X-Y stage 7 and position the inspected substrate 15 in the observation field of the macro observation system 3. At this time, the spotlighting light by which outgoing radiation was carried out from spotlighting equipment 19 presets the X-axis address counter 29 and the Y-axis address counter 31 for the coordinate when having consistency at the point on the inspected substrate 15 specified by down stream processing of (1) (S) as (XXX, YYY). Consequently, memory of the relative distance between an object optical axis and spotlighting is carried out to the coordinate display 9 about the point (S) specified on the inspected substrate 15. After this processing is completed, first, X-Y stage 7 is moved into the observation field of the macro observation system 3, and the appearance of the inspected substrate 15 is observed.
[0027] When a part for a defective part is discovered in macro observation, the inspected substrate 15 is moved and the spotlighting position of spotlighting equipment 19 is made to adjust a part for this defective part by X-Y stage 7. At this time, a foot switch 33 is pressed and the counter value of the X-axis address counter 29 of the coordinate display 9 and the Y-axis address counter 31 is preset to (XXX, YYY). Then, the inspected substrate 15 is moved in the micro observation system 5 direction by X-Y stage 7, checking each counter value of the X-axis address counter 29 and the Y-axis address counter 31. Movement of X-Y stage 7 is stopped in the position where the counter value became (0, 0). Consequently, adjustment arrangement of the part for the defective part of inspected substrate 15 front face is carried out under the object optical axis of the micro observation system 5. And micro observation for a defective part of inspected substrate 15 front face is performed through a microscope 27.
[0028] Thus, with the substrate observation equipment of this example, a part for a defective part can be adjusted under the object optical axis of the micro observation system 5 simply only by checking the counter value of the coordinate display 9, and with high precision, putting the inspected substrate 15 on X-Y stage 7, after making a spotlighting position adjust a part for the defective part of the inspected substrate 15 discovered in the macro observation system 3. For this reason, while being able to shorten sharply the time which a change with macro observation and micro observation takes, it becomes possible to raise the working efficiency of substrate observation sharply.
[0029] Moreover, CPU (not shown) is connected to the coordinate display 9, parts for two or more defective part which it is at the macro observation time and were discovered are adjusted in a spotlighting position in order, and memory of the coordinate for a defective part is continuously carried out through a foot switch 33. In this state, the inspected substrate 15 is positioned in the observation field of the micro observation system 5, and X-Y stage 7 is moved, checking an operation value [being displayed on the X-axis address counter 29 and the Y-axis address counter 31 (memory coordinate-current position coordinate)].
[0030] And movement of X-Y stage 7 is stopped in that an operation value is set to (0, 0). At this time, a part for a defective part is adjusted under the object optical axis of a microscope 27. After micro observation of this portion is completed, X-Y stage 7 is moved in the observation field of the micro observation system 5, and it is made to stop in that an operation value is set to (0, 0) again. At this time, a part for the defective part of an exception is adjusted under the object optical axis of a microscope 27. By repeating such operation, two or more micro observation for a defective part is continuously performed in the observation field of the micro observation system 5.
[0031] Thus, by carrying out memory of two or more coordinates for a defective part discovered in the macro observation system 3 continuously, into the observation field of the micro observation system 5, parts for two or more defective part can be continuously adjusted under the object optical axis of a microscope 27, and expansion observation can be carried out with the substrate observation equipment of this example. Consequently, it becomes possible to make the working efficiency of substrate observation raise sharply.
[0032]
[Effect of the Invention] Thus, with the substrate observation equipment of this invention, a part for a defective part can be adjusted under the object optical axis of a micro observation system simply only by checking the counter value of coordinate display, and with high precision, putting an inspected substrate on an X-Y stage, after making a spotlighting position adjust a part for the defective part of the inspected substrate discovered in the macro observation system. For this reason, while being able to shorten sharply the time which a change with macro observation and micro observation takes, it becomes possible to raise the working efficiency of substrate observation sharply.
[0033] Moreover, by carrying out memory of two or more coordinates for a defective part discovered in the macro observation

system continuously, into the observation field of a micro observation system, parts for two or more defective part can be continuously adjusted under the object optical axis of a micro observation system, and expansion observation can be carried out with the substrate observation equipment of this example. Consequently, it becomes possible to make the working efficiency of substrate observation raise sharply.

[Translation done.]

Drawing selection [Representative drawing]



[Translation done.]